Journal of the Royal Society of Arts

NO. 4940 FRIDAY, 10TH DECEMBER, 1954 VOL. CIII

FORTHCOMING MEETINGS

WEDNESDAY, 29TH DECEMBER, at 2.30 p.m. DR. MANN JUVENILE LECTURE. '*Spies in Fact and Fiction*', by Bernard Newman. (The lecture will be illustrated with lantern slides. Admission by special ticket only. See notice below.)

MONDAY, 3RD JANUARY, at 6.30 p.m. FILM EVENING. (See notice below.)

WEDNESDAY, 5TH JANUARY, at 2.30 p.m. DR. MANN JUVENILE LECTURE. '*Some Mysteries of Metals*', by Professor E. N. da C. Andrade, D.Sc., Ph.D., LL.D., F.R.S. (The lecture will be illustrated with experiments. Admission by special ticket only. See notice below.)

THURSDAY, 6TH JANUARY, at 5.15 p.m. COMMONWEALTH SECTION. HENRY MORLEY LECTURE. '*The Copperbelt of Northern Rhodesia*', by R. L. Prain, O.B.E., Chairman, Rhodesian Selection Trust Group of Companies. Sir Gilbert Rennie, G.B.E., K.C.M.G., M.C., High Commissioner for the Federation of Rhodesia and Nyasaland, will preside. (Tea will be served from 4.30 p.m.)

JUVENILE LECTURES

Special tickets for the two Juvenile Lectures which are announced above are now available, and will be sent to Fellows on request, as far as the accommodation of the hall permits.

Fellows are entitled to apply for tickets admitting one adult and two children to each lecture, and should state their exact requirements within this limit when making application.

FILM EVENING

The second Film Evening of the session will be held on Monday, 3rd January, **at 6.30 p.m.**, and the programme will consist of the following films: *Tom Schuler—Cobbler Statesman*, *Corral*, *The Road to Fame*, and *Looking Around No.* 1. As is the custom with the January Film Evening the films have been chosen with a view to the possibility that some Fellows may care to bring their older children on this occasion.

Tom Schuler—Cobbler Statesman (27 minutes) is a coloured cartoon which tells the story of the formation of the Union and Constitution of the United States of America. The wit of its script writer and artists has converted an apparently dull subject into an extremely entertaining story. The film was produced for the U.S. Information Agency.

Corral (12 minutes) was produced for the National Film Board of Canada by Colin Low. It depicts the breaking in of a wild horse by an Alberta cowboy, and makes visual poetry of a simple theme. As the picture speaks for itself there is no commentary, but the film has a charming musical accompaniment from two guitars.

The Road to Fame (25 minutes) is a colour film which tells the story of the Sunbeam Talbot Alpine car which was introduced in 1953. The film gives an insight into the tests to which the car was first submitted, including speed trials on famous Continental racing tracks, followed by the 1953 Alpine Rally. The film was, of course, produced for Messrs. Rootes, Ltd.

Looking Around No. 1 (10 minutes) is a magazine film in colour produced by the Wellcome Film Unit. It includes three items: (*a*) Sealed in Resin, with commentary by David Lloyd-James, (*b*) The Naked Mole Rat, with commentary by Gerard Hoffnung and (*c*) Taballet.

Tickets of admission are not required, and Fellows are entitled to introduce two guests. Light refreshments will be served in the Library **beforehand** from 5.45 p.m., at a charge of one shilling a head.

JOURNAL INDEXES

As announced in the *Journal* of 12th November, the index and title page for Volume 102 will be sent free of charge to Fellows who apply for them.

Binding cases for the *Journal* can be obtained direct from the Society's bookbinders, Messrs. P. G. Chapman & Co., Ltd., Kent House Lane, Beckenham, Kent, on payment of four shillings and sixpence, post free. An index and title page will be included.

Copies of the ten volume index, covering the period November, 1942, to November, 1952, are also available and will be sent on application to the Secretary. The price is five shillings.

REVISED LECTURE PROGRAMME

A leaflet containing the revised programme of arrangements for the present session is included in this issue of the *Journal*.

THE SOCIETY'S CHRISTMAS CARD

An order form is included at the end of this issue of the *Journal* to give Fellows a last opportunity for ordering the Society's Christmas card.

LIFE IN THE YEAR 2000

The essays which won the first two prizes in the Bicentenary Competition, read by their authors to the Society on Wednesday, 24th November, 1954, with Sir Alfred Bossom, Bart., F.R.I.B.A., M.P., a Treasurer of the Society, in the Chair

SIR ERNEST GOODALE, C.B.E., M.C. (A Vice-President of the Society): First of all I have to apologize on behalf of the Chairman of Council, Mr. Munro Runtz, for his absence to-day. Unfortunately he is laid up again, in pain, and as he is not able to be here this afternoon, I am deputizing for him.

Before we come to the main business at this afternoon's meeting, which is to listen to and discuss the essays which were submitted for the Bicentenary Competition by Wing-Commander Cave-Browne-Cave and Mr. Watson, it is my privilege, on behalf of the Chairman of Council, to hand to them and the other recipients the prizes which have been awarded for their entries. Before doing so, however, I would like just to remind you of the nature of the Competition, which was first announced at the Inaugural Meeting of the 200th Session by our President, H.R.H. The Duke of Edinburgh.

The general subject of the Competition was stated to be 'the practical aspects of Life on this Earth in the Year A.D. 2000', and individual competitors were required to submit their forecasts on a single aspect of life at that period. Substantial prizes were offered, and a considerable time was allowed for the submission of entries, which might be in the form of essays, models or drawings.

As has already been said, the judges appointed by the Council for this competition were somewhat disappointed at the general level of the entries which were received, but I do not think that we should take this too much to heart. This result only goes to prove the need for the looking ahead which it was the object of the Competition to stimulate, because it has shown how difficult it is to do so effectively. We are indebted to all who heeded our challenge and entered for our Competition, and we hope that those who were unsuccessful will not be discouraged by the result. I think I might say that the Council of the Society are satisfied that the Competition was a very proper one to hold, and they are seriously considering whether the offer should not be renewed in perhaps a slightly different form in possibly one of the Sections.

I should like to take this opportunity of expressing publicly the gratitude of the Council to the very distinguished body of ladies and gentlemen who devoted their time and great experience to the reading and judging of the 184 essays and other entries submitted.

It is now my privilege and pleasure, on behalf of the Chairman, to present the awards to the prizewinners, and after that I will hand over the Chair to my colleague, Sir Alfred Bossom, who will preside for the remainder of the afternoon's proceedings.

The following presentations were then made:

A prize of £50 to Wing-Commander T. R. Cave-Browne-Cave, C.B.E., F.R.Ae.S., M.I.Mech.E.: for a scheme for roof-top roadways.

A prize of £20 to C. E. H. Watson, B.Sc (N.Z.), M.I.C.E., A.M.I.Mech.E.: for a system of underground roadways for London.

A prize of £10 to the Rev. C. W. Gibbons, B.Sc.: for a paper on education.

A prize of £10 to M. B. McEvedy, M.A., B.M., B.Ch., D.Obst.: for a paper on microbiological products.

F. R. East, A.C.I.S., was unable to attend to receive his prize of £10 for a paper on synthetic food.

The Chairman introduced Wing-Commander Cave-Browne-Cave and Mr. Watson to the meeting, and the following essays were then read:

I. A SCHEME FOR ROOF-TOP ROADWAYS

By Wing-Commander T. R. CAVE-BROWNE-CAVE, C.B.E., F.R.Ae.S., M.I.Mech.E.

May I first thank the Council for the prize awarded to me for this admirably conceived and appropriate competition, and may I say how much I appreciate the opportunity of reading my Paper to our Society and having it discussed?

There can be little doubt that in A.D. 2000 there will be great concentrations of people in large towns engaged in administration, commerce and industry. These concentrations tend to convenience and efficiency but are limited by problems of traffic flow and the provision of suitable buildings.

At present we seem to be approaching deadlock by traffic strangulation and this will become more acute as bombed site car parks become again used, not for cars, but for buildings housing more people. Those working in the central area will wish to live either sufficiently close at hand to avoid long journeys night and morning or at some greater distance which makes them dependent on streams of transport which can move with reasonable speed and freedom.

Development of these areas of efficient concentration therefore depends upon two main problems: the provision of clear channels for fast road transport; and the use of the available ground space for buildings which are most appropriately in the central area: not slums, markets, goods yards and disused railway lines.

THE TRAFFIC PROBLEM

Much long-distance through traffic can be diverted to bye-pass channels which will pass clear of these towns. There will, however, be a great deal of traffic which must be able to pass into and out of the central areas. Much of this will be heavy but capable of moving at high speed if constant checks can be avoided. The tendency to send large loads from door to door will certainly increase as industry becomes more active and construction and manufacture are done more rapidly. The inevitable delays on the railway will cause that system to be used mainly by the limited class of traffic for which it is specially suitable.

The effective speed of air travel is limited mainly by the time spent on journeys to and from the airport. Helicopters may bring the passengers from the main airport into a terminal a little nearer the centre, but that is only part of the problem, as the passengers are finally dispersed in road transport. There are great difficulties in providing and working enough helicopters to assemble

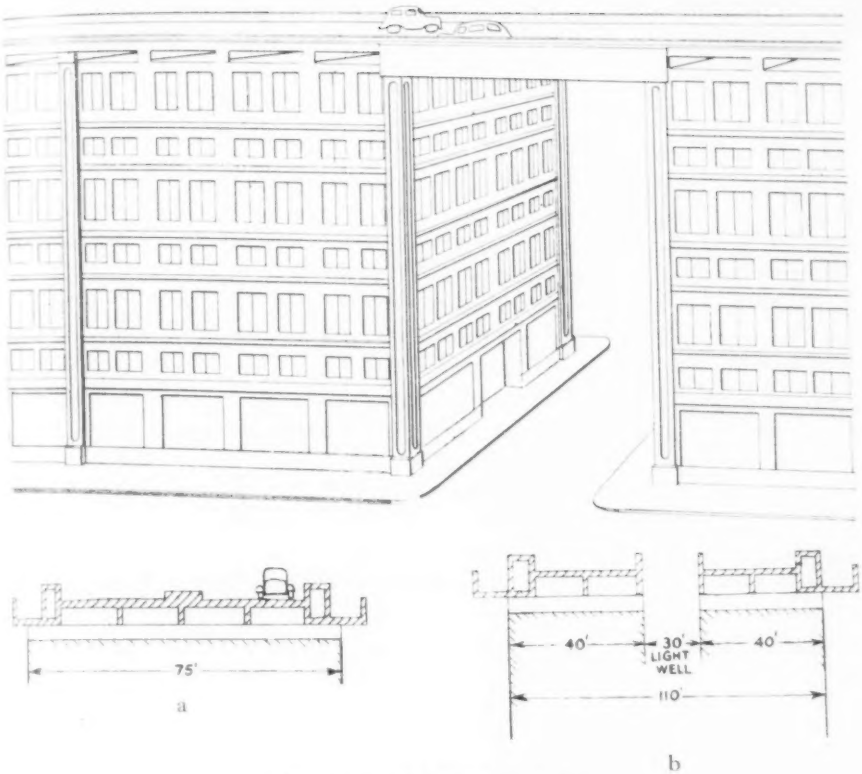


FIGURE 1. *Roof-top roadways*

and disperse all the passengers from the active airport of a large city. However greatly the reliability of helicopters may improve, there must be great danger in the event of failure above a town area.

Cars and coaches are much safer than helicopters for the assembly and dispersal of air passengers. They will be altogether more satisfactory than helicopters when clear channels for fast road transport have been provided.

At a conference of the British Association* opened by Lord Latham in September, 1946, the various methods of providing additional channels for the rapid flow of traffic in city areas were discussed. The Assistant Commissioner of Metropolitan Police explained that the essential requirement was for traffic channels passing right through the area and capable of allowing traffic to flow at a speed of forty miles an hour, without interruption from crossroads or from pedestrians. This system should be connected to the normal traffic system only at intervals of approximately one mile. Papers read to the conference showed that these channels, if constructed below ground level, would involve prohibitive difficulties because of the congestion which already exists

* Journal of the British Association, Vol. IV, No. 14, May, 1947.

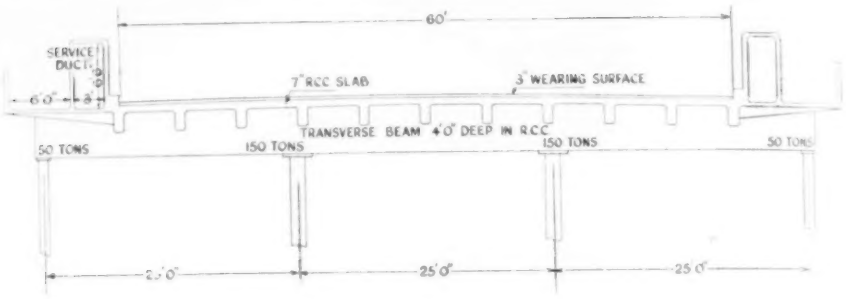


FIGURE 2. *Cross-section of carriage-way*

underground and the enormous amount of spoil which would arise. The alternative of providing them at road level along the general line of main traffic arteries involves prohibitive expense by reason of the interference with valuable frontages and the dislocation of traffic in the main arteries while the widening is taking place. To cut new traffic channels along lines parallel with these main arteries, where less valuable frontages are involved, still necessitates crossing many side roads and the interruption of underground services. To carry the new traffic channel on a viaduct at moderate height above the ground avoids certain of these difficulties but involves great expenditure in new construction.

BUILDINGS

In addition to the traffic problem there is that of providing buildings in which administration, commerce and industry can be carried on and in which those people who wish to live near their work can do so in good health and comfort. Experience shows that the types of building found most suitable for each of these purposes are basically much the same. Offices, shops, factories, storehouses and flats all have much the same essential framework. They are steel-framed buildings going to a height of about 100 feet with a depth from front to back of about 100 feet. They may have light wells along the central axis. The length of the blocks varies greatly according to local requirements. Blocks might, however, be made of great length with arches over crossing roads.

The top surface of buildings is not normally used for an important purpose. Where it is possible to arrange many of these buildings in a continuous line it is possible to carry the traffic artery along the roof. The cost of the buildings themselves will not be greatly increased and there will be an effective and economical contribution to the solution of both the traffic problem and the building problem.

The general form of such a viaduct is shown in Figure 1. The structure may well be that of a normal steel-frame building 100 feet high but carrying, instead of its normal top story, a structure which will support normal roadway slabs and transmit the load to the main columns of the building. The roadway will

have an open width of sixty feet between kerbs (Figure 1*a*) or preferably two separate lanes leaving room for light wells along the axis of the building (Figure 1*b*). Along the outer edges of the roadway there must be a parapet just low enough to allow passengers to see over it. The parapet will form a duct for mains and services with easy access from a footway formed outside it.

Calculations made for the author by Mr. D. McPherson, M.I.C.E., showed that a roadway sixty feet wide between kerbs added on top of a typical steel-frame building 100 feet high will increase the loads in the columns and on the foundations by less than twenty per cent, and will be well within normal practice. The estimate adopted Ministry of Transport loading with allowances for live load and impact in accordance with current practice. The investigation leads clearly to the conclusion that from the constructional point of view roof-top roadways are a feasible proposition (Figures 2 and 3).

The approaches to the new roadways will be formed as sloping spurs arranged at intervals of about one mile on both sides of the main roadway. The gradient of these spurs will be 1 in 10, involving a length of about 800 feet in coming down to ground level. Gradients of this steepness are quite satisfactory on many existing main roads and should be quite acceptable for traffic joining or leaving the main viaduct. The spurs need not necessarily be straight but may curve round so as to conform with the direction of the streets with which they will connect at ground level.

At the junction of each spur with the main viaduct a roundabout will be formed twenty feet under the level of the main roadway so that vehicles can leave or join the main streams. A driver can change from one main stream to

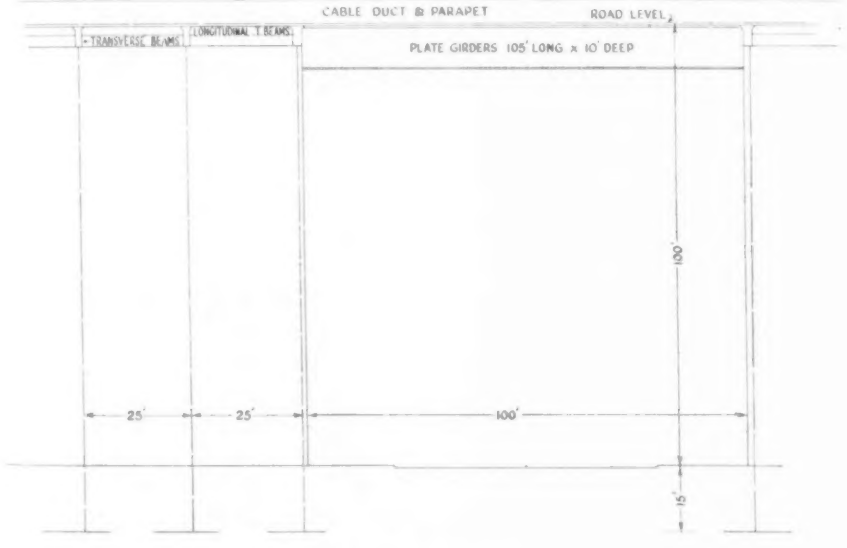


FIGURE 3. *Elevation*

that flowing in the opposite direction by going down to the roundabout and up on the other side (Figure 4).

The sloping spurs offer a convenient opportunity for providing garage accommodation on successive floors say fifteen or twenty feet apart in height. The spurs will be seventy feet wide with twenty feet wide entry at each level between the up and down lanes. Cars will be parked diagonally with a turning circle at the inner end under the junction of the spur with the main roadway. Each spur will provide parking space for about 500 vehicles (Figure 5).

Location of the viaducts is a matter of town planning. The greatest difficulty lies in passing buildings of national importance or of immense value. On the

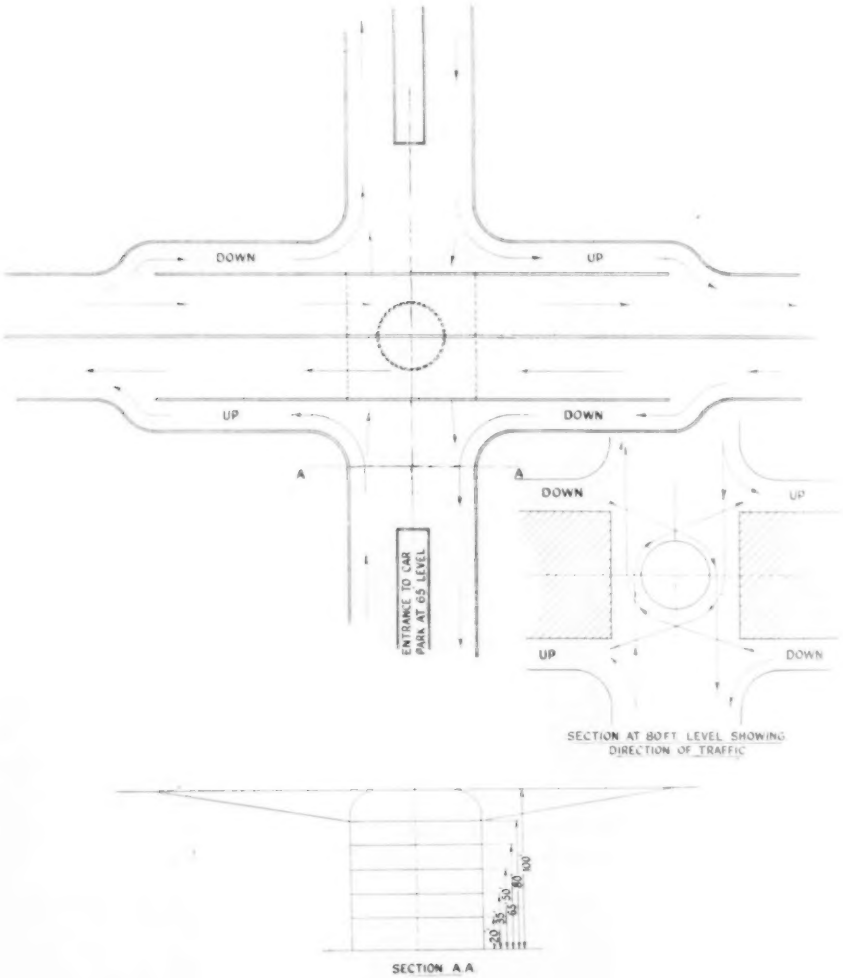


FIGURE 4. *Entrance to main roadway, 80–100 feet*

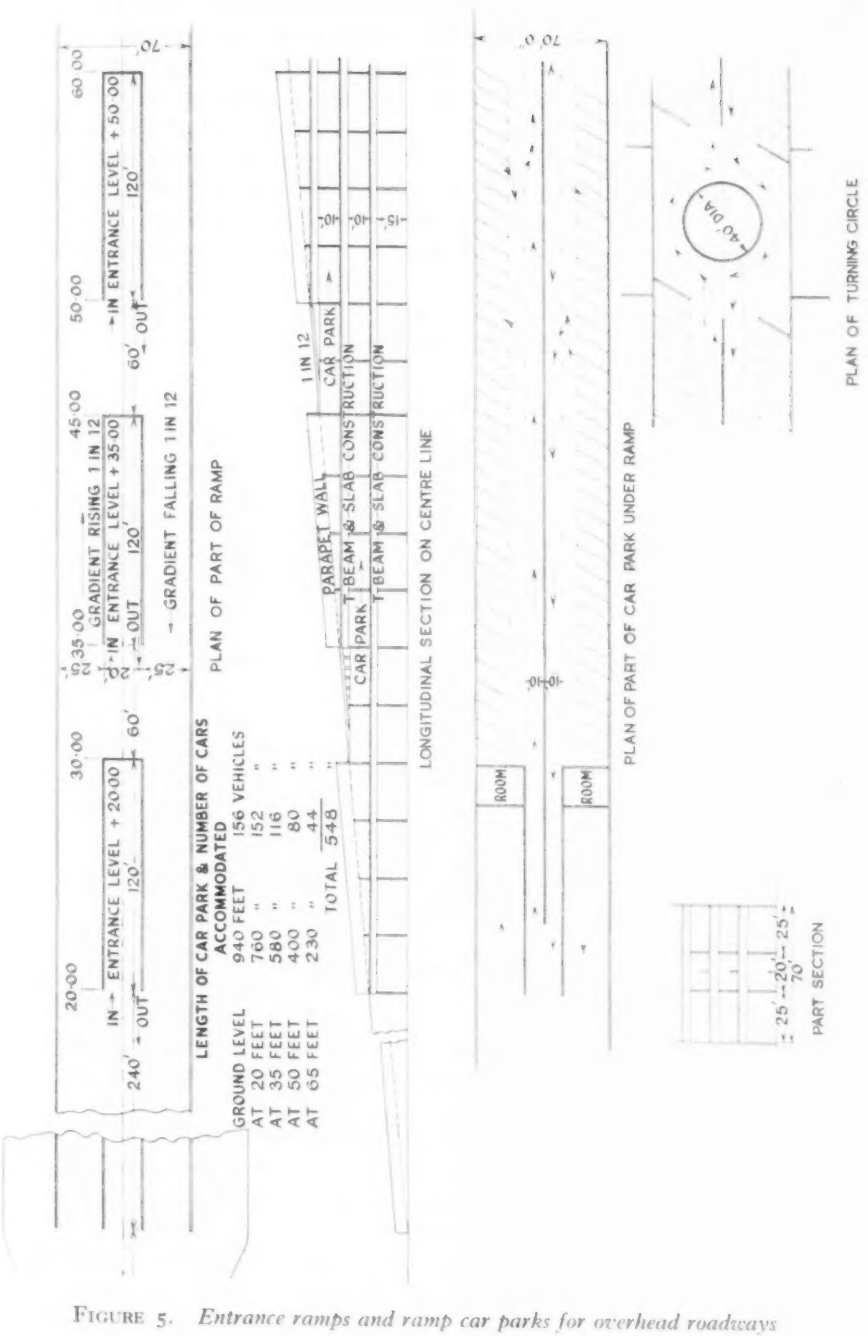


FIGURE 5. *Entrance ramps and ramp car parks for overhead roadways*

other hand, slums, markets and disused railway lines offer easier and more desirable passage.

One viaduct might well start from the present blank end of Western Avenue at Shepherds Bush and follow a course lying between Oxford Street and the main line railway stations to connect with the junction of Mile End and Commercial Roads or perhaps to continue further east through the devastated area to the Barking Bye-Pass itself. If the viaduct were planned as a whole it would be convenient to construct a few sections at a time using the access spurs in their final position and form. The Eastern section from a spur near Kings Cross to the Eastern end near the Docks and the Barking Bye-Pass through the much devastated area might form a convenient and useful beginning. On ring roads of the roof-top type a steady speed of forty miles per hour would be possible as there are no crossings, but spurs connect to each great road.

PROVISION FOR TRAFFIC FLOW

If we review the plan in relation to the traffic problem it seems to meet most of the requirements.

Traffic can pass along each lane at continuous high speed as there are no cross roads. Vehicles peel off or enter into the main stream by side channels which do not interrupt the main flow. Heavy vehicles which cause much delay at traffic lights by reason of their large size and slow acceleration will not cause this trouble on the viaduct.

The provision of large garage capacity in the spurs makes it possible for many of the cars and service vehicles which come in by the viaduct bringing people to work in the central area to pass direct to the garage space of the most convenient spur without entering the ground level traffic system at all. The arrangement for getting cars into and out from the various floors of the garage is simple because the sloping roadway of the spurs gives easy access to either stream on the viaduct and to the ground level traffic system.

The complete absence of pedestrians, cyclists and crossing vehicles should almost eliminate road accidents and will assist safe and rapid flow.

THE ADVANTAGE OF LONG CONTINUOUS BUILDINGS

Economy of Fuel and Power

In various sections of the building, for whatever purpose they are used, there will be a demand for electric lighting and power. This requirement alone would best be met from the public electric supply. There is, however, also a demand for low-temperature heat for hot-water supply, space heating and in some cases for process steam. The loss of heat from a long continuous building will be far less than from the greater surface of smaller buildings of the same total effective capacity. This in itself helps economy. The distribution of heat throughout the building and its temporary storage in water tanks are easier in a continuous building.

The development of the gas turbine makes it possible to develop electric

power efficiently in units of moderate size. These units can be conveniently distributed along the building. The waste heat available from their exhaust is considerable and is at a temperature sufficiently high to make it easily available for the heating requirement. Ease of storage and distribution help to deal with variations in demand for electric energy and for heat. In summer, when the exhaust heat available may exceed the demand for use and storage of heat, the surplus can be simply discharged to the atmosphere. The whole system may therefore be made remarkably simple and efficient.

If atomic power generation has been sufficiently developed by A.D. 2000, the electric energy may be derived from atomic units replacing the gas turbine units distributed along the building. Waste heat will be available for storage and distribution and the occasional supply of atomic fuel may be even as simple as the supply of oil fuel for the turbine units.

General Amenities

The noise caused by the flow of traffic along the viaduct will be very much less than that of traffic moving along a normal street and reverberating between the buildings. The airborne noise deflected upwards by the parapet will not come down, to an audible extent, to adjacent buildings, still less to ground level. The vibration caused by pneumatic tyred wheels on the concrete structure of the roadway will not be audible in the buildings of the viaduct. It must be clearly realized that these conditions are entirely different from those in a railway viaduct when steel wheels are moving over the joints and crossings in steel rails carried direct on the main structure. Inside the structure of Waterloo bridge the passage of traffic along the roadway is inaudible. The vibration of the structure is barely discernible even with a stethoscope.

The exhaust gas from vehicles is unpleasant and possibly dangerous in the congested traffic of city streets. The exhaust gas from vehicles on the viaduct will be quickly dissipated and quite harmless. The exhaust from vehicles in the spur garages will pass out through side windows without the artificial ventilation necessary in underground garages.

The concentration of useful accommodation in these viaduct buildings is so much greater than it was in the former jumble of old buildings that the same total useful capacity per square mile could be achieved leaving room for open spaces and schools, which must be at ground level and adjacent to the accommodation in the viaduct which overlooks them.

The viaducts with arches spanning each main street offer to the architect the same scope for variety and distinctive treatment as did the now famous terraces of acknowledged architectural beauty. They will obstruct the view from street level no more than do present high buildings. They contribute for the passengers on the viaduct and its footway an entirely new view which will be much more extensive than that from ground level and much more intimate and satisfactory than that from aircraft.

Almost the whole volume of the viaduct structure constitutes useful accommodation which will earn the same revenue as conventional buildings

made without roof roadways. The viaducts will, at little extra cost, also provide really good traffic channels to meet a demand which is rapidly becoming vital.

WILL IT HAPPEN?

The plan may at first sight appear to involve prohibitive expense and prohibitive administrative difficulties in construction.

I submit that these difficulties are not as great as those involved in any other plan which would make an equal contribution to the improvement of traffic and also to the provision of good profitable building with open spaces; the whole being capable of grand architectural development.

The question of how much of this development will have been achieved in the forty-six years before A.D. 2000 will chiefly depend upon the action taken by the Royal Society of Arts at this stage.

II. A SYSTEM OF UNDERGROUND ROADWAYS FOR LONDON

By C. E. H. Watson, B.Sc.(N.Z.), M.I.C.E., A.M.I.Struct.E., A.M.I.Mech.E.

I should like first to thank the Royal Society of Arts for the opportunity of reading my essay, and for the prize that has been given.

Away back in the nineteen-fifties men of goodwill in every land had been sorely troubled in mind and spirit. The cause was not far to seek, for it seemed in those days that only a miracle could save the great cities of the world from atomic extinction. And if it did, an even more dismal fate loomed large—death by slow strangulation, in the toils of their hopelessly obsolete and inefficient transport systems.

Rudely handled within living memory, when civilization suffered near-eclipse, but now rising to new glory in the Atomic Era as the mighty heart of a world-wide family of nations, London is very far from defunct. What is more, and rather incredibly, it is still much the same old London. Proud indeed she rightly is of her heritage and her power to command ever-growing pilgrimage from the ends of the earth to her unique and ancient ceremonies, yet proud too of her newly-won reputation as the most streamlined city of the age. Long since forgotten is her fretful embarrassment at the immense expansion of her population. Notwithstanding the violent storms of the twentieth century, there is a superb serenity about her well-housed, well-nourished twenty millions as they make ready to welcome a record influx of guests for Her Majesty's Golden Jubilee. A dynamic air of achievement is stirring the Old Country. After cool calculation and much heart-searching, but true to form, the Englishman has found a comforting compromise—only this time it is on a seismic scale that has shattered the rest of humanity.

Panting somewhat after his prodigious and unwonted exertions he is now beaming virtuously upon mankind over Pickwickian spectacles. For are not the

pioneering steps taken by his far-sighted ancestors proving as snug an investment as ever tantalized the coffers of the foreign competitor? It all seems logical enough now, but the struggle was both long and hard. History may judge that the crowning achievement of the new Elizabethan Era has been the reconciliation between those two well-meaning but equally myopic factions, the 'Do-Nothing Brigade' and the 'Clean-Sweep Contingent'. The resulting upsurge of energy has swept all before it throughout the Commonwealth. The one-time Dollar Gap has been metamorphosed into the Sterling Gulf.

It was in 1953, most happy and resplendent year of the Queen's Coronation, when great achievements, great international tensions and powerful inspiration filled the air, that Youth was roused to opportunity and to daring, not only in far fields but at home on its very doorstep. Wise and patient statesmen of many lands had caught a vision of the year 2000, and had risen nobly to their thankless task of guiding the Common Man, groping faithless and befuddled on the very brink of doom, by slow and painful steps back to sanity and lasting peace. The United Kingdom's defence bill had reached the fantastic annual total of sixteen hundred million pounds, and that of mankind some twenty times that figure—this in a world supposedly at peace, a divided, foolish world in which the astronomic resources of two camps roughly cancelled out into barren nothingness, economic stalemate and ultimate starvation. Recoiling in horror from the yawning chasm of atomic annihilation, and bringing belated reason to bear upon this grim paradox of self-inflicted burdens, thoughtful men everywhere began to plan carefully for the day when this vast, wasteful flood of expenditure could safely be diverted to productive channels.

Fittingly, it was in ancient and battle-scarred London, home of the Mother of Parliaments, centre of the Commonwealth and seat of the Throne, that men took the first historic steps to banish the irrational fears that had tortured the world for half a century. Lest her good example should not readily be followed, London kept her feet on the ground, blending faith and bold action with caution so that external trouble could not take her unawares.

Choked and paralysed by the stark inadequacy of her road system, and noting the frantic struggles of other great cities wrestling with wholesale demolitions and population transfers to bulldoze a way for the flood of modern traffic, she first ordered a comprehensive investigation into the cost of goods and services. The result was an eye-opener into the staggering cost particularly of road transport and handling charges. The economic shoe was pinching sharply, and both American and Continental competitors had gained a disturbing lead, not least by early attention to their traffic problems. Their considerable streamlining of transport, backed by good husbandry and an innate capacity for hard work had paved the way to their industrial dominance. The danger flag was out with a vengeance for a Britain still clinging pathetically to the new-found comfort of her Welfare Shawl, rather than rejuvenating her arteries and circulation for protection against the economic blast.

The Nation began to bestir itself. Money was voted, in a modest trickle at first, for research into the formidable problem of streamlining the traffic that

would be London's in the twenty-first and later centuries, while zealously safeguarding her ancient character. The right of noble shrines and entrenched interests to retain possession of their time-honoured sites, in proud disdain of the flood tide of modern mechanical creations lapping sluggishly about their portals, was the rock upon which many a worthy scheme had foundered. Time passed while controversy raged and economic pressures tightened their grip. The inevitability of gradualness proved an intractable enemy of one surface project after another. At long last, however, a truce between ancient and modern was hammered out, by driving deep underground the vital urge for speed and efficiency—to the seclusion of the Chalk Beds. Comprehensive planning was begun forthwith, unhampered by the disheartening human obstacles to surface schemes of the same magnitude.

The traditional outcry about technical and financial feasibility was countered by recollections of the Mulberry Harbour exploit of 1944, when, under the goad of dire need, and under fire, 'the difficulties had argued for themselves', and the 'impossible' had been achieved on schedule. Somebody clinched the matter by computing that the huge volume of chalk already mined on an unplanned basis would have provided the tunnel system by 1980, had the project been put in hand fifty years earlier.

In broad outline the scheme envisaged a vast radial and circular network of fast, all-weather, arterial roads tunnelled in the chalk, and connected with its older, slower, surface counterpart by means of helical ramps rising from roundabouts sited at the intersections and designed to allow streams of fast traffic to cross one another at speed, or to emerge via the ramps to ground level, or to find their way to superimposed multi-story car parks, hotels, offices or residential blocks.

The problem of ground water began to be studied regionally with a view to enlisting it as an ally rather than an enemy of construction, and as an eventual permanent asset. Preliminary surveys, borings and plans were made for locating the best places for the helical ramps and car parks, making optimum use of bombed sites and of topography. The ramped structures were given overriding priority to provide urgent relief from the throttling congestion caused by street parking, which had reached such a pass that the despairing counsel of banning cars altogether from the city was gaining powerful support. Eminent consulting engineers and contractors collaborated, both on pre-planning and throughout the work, to a degree hitherto unknown. Mechanical and electrical experts tackled the design of the necessary specialized constructional plant for large-scale excavation, materials-handling, lining and finishing requirements. Fertile brain power no longer exhausted itself in ulcerous wrangling between opposing camps, locked in verbal combat over contractual niceties and marginal profits, to extract a bare living from the dwindling crumbs left by the tax-collector. The new régime functioned as co-ordinated teams, supported from start to finish by infusions of current scientific knowledge drawn from many cognate fields of endeavour, with the common-sense objective of increasing the size of the cake for the benefit of all. The vital competitive spirit was not only

retained but stimulated within the overall plan, by pitting group against group in honourable and exciting rivalry, with a fair living for all, and the highest awards for the best results. The whole project, being capable of rapid expansion or contraction to suit world economic fluctuations, acted as a sensitive regulator of employment throughout the Kingdom. In the thrill of achievement men forgot unworthy demands upon their fellows. At the outset researches were begun on the most profitable use to be made of the materials from the excavations and of those needed for the permanent structures. Prospects of continuing artificially the beneficent, fertilizing glacial action of the Ice Ages were investigated so as to use the more suitable calcareous spoil for liming agricultural land on an extensive scale, by road, rail and even by air. The Armed Services found themselves in great demand in peacetime for these and other productive activities, with considerable benefit to their morale and to the community.

This history is instructive, for it reveals that it is not by mere chance that the greatest of cities has succeeded in doubling her size in the last half-century without sacrificing her old-world splendour. She has done even better, for she has underpinned her intricate economy with an underground defence, transport and power system second to none and integrated with that of the rest of the Kingdom and beyond.

It is perhaps through the keen and appreciative eyes of a Londoner—long exiled on his antipodean farm, and now returning home to recapture the scenes of his youth, where forty-seven years ago he had shared in the Coronation—through these progressive but homesick and critical eyes, that we can best appraise this new London of A.D. 2000. He is grateful that the 12,000-mile journey can be made in the economical and comfortable luxury of a 150-seater turbo-prop flying-boat, all the way from the outermost realm to the very heart of the Commonwealth. Thanks to the great extension of smokeless zoning, the spring sunshine has a new clarity, and as he circles over them his heart warms to the old familiar landmarks. The progressive instinct that had prompted his emigration quickens at the sight of concentric rings of novel and imposing buildings. At their bases streams of traffic are entering and leaving the bowels of the earth, and on their summits helicopters are alighting and taking off. Beyond these rings of handsome structures lies the Green Belt, still gloriously unspoiled, then another circle of special buildings, and finally the broad annular ring of garden suburbs and satellite towns, their character in harmony now by virtue of their easy access to the hub of the city. Within their well-watered and generous plots they house in comfort ten million new citizens. Self-contained communities, once beset by human problems of isolation, they are now woven into the general pattern and warming to an abiding contentment, linked as they are within half an hour of Buckingham Palace and other magnetic focal points. According to their means or their fancy they may choose all-electric railway (on the now completely-electrified national system, in which the names of approaching stations are thrown upon screens within the compartments—a revolutionary boon to natives and visitors alike), or diesel-electric railcar, tube railway, coach or motor-car on the streamlined tunnel system, or even helicopter. Beyond the

new suburbs may be seen, like the radiating spokes of a colossal wheel, the broad dual motorways linking London with other great cities, and designed for safe speeds of a hundred miles an hour.

In striking contrast to 1953 the surface traffic in central London is no longer congested and hamstrung by random parking of cars and lorries. In fact they seem almost to have disappeared. The familiar red buses abound, but they go faster and farther in their greater freedom, to ease the pressure on suburban tubes and railways. Something of the leisured elegance of bygone days has reappeared in the landaus plying quietly among the taxis and ubiquitous cycles. All move freely in greater safety now that the fast and heavy traffic with its strident note of efficient hustle (no more welcome for its undoubted necessity) is mercifully hidden from eye and ear. The air is purer and healthier for the change, and the Londoner's temper noticeably sweeter. Tourists flock in ever-growing numbers to the magnificent hotels.

The flying-boat alights on a large freshwater reservoir near the old Heathrow Airport. This great artificial lake is hexagonal in plan, oriented to give optimum take-off conditions for flying-boats along its three diagonals, and has a two-mile-long airstrip for land-planes on each of its six sides, which form a wide, continuous impounding bank of spoil excavated from the underground road and parking system. One of the radial tunnels passes under the Air Terminal so that for the brief journey to the city there is a choice of public coach, private car or helicopter, giving widespread links with both near and remote destinations.

By reciprocal agreements with the Dominions and other countries, the more irritating passport and customs formalities have been eliminated—another step on the road back to international sanity. Choosing the coach, the visitor finds himself spiralling rapidly down past floor after floor of parked cars, whose owners administer the airport or maybe are about their business by air to all corners of the Kingdom. Via the roundabout at the bottom he reaches a tunnel of impressive dimensions in which are accommodated two lanes of traffic scurrying in each direction. He filters into the faster lane and cruises at a steady seventy miles an hour, passing ring roads without pause for there are no level crossings, no traffic lights, and no 'Road up' signs to interrupt the flow because all services are now housed in accessible ducts. Road surfaces, being protected from the weather, are both smoother and more durable. London Transport now takes fogs, smogs and freeze-ups in its stride.

The roundabouts serve for changing direction, interconnection of radial and ring roads, or access to helical ramps. These in turn lead to underground or multi-story car parks and shops, with express lifts serving all floors, or to the surface system of roads and buildings. Some of these ramps are constructed as inclined carriageways 'wrapped round' concrete shells that serve both as cooling towers to underground power stations (oil-fired, coal or atomic), and as a means of inducing draught to supplement the ventilation of the tunnel system and reduce its maintenance cost. Grids at the top of the shells enable the draught also to assist helicopters in alighting and taking off and so minimize their noise

nuisance, an advantage still further enhanced by raising the height of these structures well above the general level of London's buildings. The underground power stations ensure power, heat, light and district heating for the surface community and for the tunnel requirements.

Our visitor reaches his luxury hotel somewhat dazed by his impression of stupendous changes below the ground, in sharp contrast to the timelessness of the old familiar scene above. It is comforting to reflect that the new no longer seeks to destroy the old and the good, but, paradoxically, will sustain it throughout the centuries to come.

Immense economies have followed long-term, comprehensive planning by construction teams resulting in the use of purpose-made tunnelling machines, developed from the modernized coalmining equipment; the conveyor-belt or hydraulic disposal of spoil for agriculture and for embankment construction; the production of building stone, plastic-reinforced bricks, which supplements and conserves the dwindling supplies from the London Basin for high-grade concretes, cement, plaster and other derivatives—superseding the former widespread but haphazard and unsightly chalk quarrying; prestressed concrete for joint-free, *in situ* tunnel linings and road carriageways; soil stabilization for trunk roads; roof and wall-bolting of excavations; simultaneous mechanical excavation and lining of tunnels; the *in situ* case-hardening of raw chalk; the co-ordination of ground water lowering as a temporary constructional expedient or permanently for water supply in conjunction with a revolutionized canal and water-grid system; the provision of Thames flood storage capacity beneath the tunnel roadways, with outlet to a coastal atomic pumping station; the growing tendency towards sky-scrapers bedded on the chalk with its tenfold greater bearing capacity than the clay above it; the access to places of mass assemblage by fast routes; the safe storage of food, fuel and goods; efficient insulation and the use of heat extracted in refrigeration; the exploitation of tidal forces; the development of underground research establishments; aerodromes for horizontal and vertical take-off, rocket armouries and civil defences; the housing of utility services in accessible ducts clear of carriageways; the inter-connection of United Kingdom with Continental electrical systems to balance respective peak loads; the integration with European road systems via the newly-completed Channel tunnel; the reduction of wear and tear, maintenance, fuel consumption and accidents; the tremendous fillip to the constructional, motor and all other industries; the photoelectric and electronic collection of tolls; the improved public health; and above all else the spiritual uplift that accompanies the surmounting of baffling problems of gigantic proportions and significance.

Of the many stirring signs of Britain's resilience that our visitor will carry back to his eager grandchildren, none etches itself more deeply than that last impression as the flying-boat soars homewards into the night. Most of the great city's lights have gone out, but endless convoys of heavy lorries with probing headlamps hurtle along the radial highways into the gleaming ring road, where the tunnel mouths swallow or disgorge them unceasingly—a scintillating garland round the Throne, symbol of the Atomic Age itself, noble reminder of man's

greatest conquest (victory over himself), and an inspiration to his restless, everquesting soul, for the next two thousand years.

DISCUSSION

MR. M. F. BARNARD: I do not see the necessity of pedestrian ways on the roof-top roadways if the streets are still open below. Secondly, it seems to me to be a big undertaking to have ramps every mile if the ramp itself is nearly 300 yards long each way, 600 yards in all, occupying over a quarter of the whole distance of the high road. Thirdly, will it not create congestion like that we have at the moment at the various places in London where the roof-top roads start?

WING-COMMANDER CAVE-BROWNE-CAVE: The pedestrian footways are primarily for access to the service mains, but I think that they will be very attractive to foot passengers. I have done a good deal of flying over London in airships at a very low height, and there is no question whatever that London seen from a low height is very good-looking indeed. I am quite sure that if these 100-foot high footways were provided, you would find that a great many people would like to go up and see it.

With regard to the ramps, they are long because they perform the very useful function of garaging cars. On the other hand, if there is no need to provide that very large amount of garage space, the ramps can quite well be made with a slope of 1 in 6, and they need not be opposite one another, nor need they be every mile unless they are required. This scheme is essentially elastic. I have elaborated the ramps to provide copious garage accommodation without putting the vehicles into the ground-level traffic system at all. I have emphasized this because it is the present urgent need, but the amount can be varied.

MR. J. H. CLAY: These two papers show that this country is not short of ideas. It seems to me that it is short of someone to put them into practice, and I think that by focusing attention on a limited area you may get more co-operation from the authorities than by a rather big scheme that may cost a very large sum of money. I should like to see a large-scale model or pilot scheme for Trafalgar Square exhibited in Central London so that all interested parties could get a clear idea of what these schemes could really do. As a layman I rather favour an elevated roadway about ten or more feet high, but now I have heard from an expert about some 100 feet up they leave me rather impressed.

BRIGADIER J. L. P. MACNAIR: These two papers go into the subject well but miss out a very important point: cost. This has not really been considered by either of the speakers in any sort of detail. Until somebody has done this, there is no possibility of anybody even considering these schemes.

Both these schemes envisage cars whizzing along at 70 miles an hour because there are no crossroads. But, of course, there must be crossroads. You cannot have these arterial roads across the roof tops or underneath the ground going only in one direction. The houses carrying the road are 100 feet high, so the houses carrying the cross roads must be of a different height unless they are going to have an intersection. How much higher or lower are they going to be?

Thirdly, part of Wing-Commander Cave-Browne-Cave's scheme is the erection of long buildings and this is one point on which, I think, his scheme is preferable to the underground one, because, whereas neither of them considers how the schemes are going to be paid for at all, it is clear that if the authorities put up these viaducts the buildings can afterwards be let at an economic rent and pay for the scheme, provided that they can get the land and the necessary facilities for height and avoid the other buildings in the way. But life has still got to go on at ground level, and I would like to ask what sort of consideration is to be given to the poor

people who have to live at ground level and do not want to climb 100 feet every time they must get from one side of these long buildings to the other? It seems to me that these buildings have got to have fairly large means of access from one side to the other, and you might as well leave the cross roads as they are at present.

WING-COMMANDER CAVE-BROWNE-CAVE: I have not worked out the cost of building a mile of roadway, because I cannot. But the thing that is quite clear is this: that if it had been possible to arrange that a large proportion of 100-foot high buildings which have been and are being built in London could have been built on one planned line, you could have put a traffic roadway along the top of them for, I will not say no cost at all, but for a very small cost. That is the essence of my scheme. It depends on two things, one is that you can put the roadways up there, and the other is that it does not involve a cost appreciably greater than building that amount of 100-foot high building which is needed in any case.

The question of cross roads is, I think, easy, and I am sorry I did not have space to explain it. To run one main road across another one is quite simple if you have height in which to do it. The formations would be similar to the connection between the spurs and the main road. Pedestrians or the vehicles on ground level would get from one side of the viaduct to the other in exactly the same way as at present, because where, for example, the viaduct crosses Tottenham Court Road, there would be a 100-foot bridge over Tottenham Court Road, and any side road which is considered worthwhile would have its own arch. It may only be a 15-foot high arch which would carry the existing traffic through the viaduct perfectly satisfactorily. One would be a high-level arch leaving a beautiful view right through, and the other a low-level arch like the Admiralty Arch, where the space above the traffic channels is completely filled in. I think that the pedestrians and the surface traffic will have a very much better time than they do at present.

THE CHAIRMAN: I believe if you go to New York you will find the Triborough Bridge there has answered these difficulties. I happen to be the one who originated the plan in 1908, and it has taken all this time to build it. The Wing-Commander's scheme can be perfectly practical and is actually in existence in a modified form in New York.

MR. C. E. H. WATSON: I should like to make it clear to Brigadier Macnair that I was reckoning on a two level roundabout. I was reckoning on the radial and the ring roads in the tunnels crossing at different levels just as Wing-Commander Cave-Browne-Cave visualizes them.

MR. L. G. BURLEIGH: My difficulty, like that of the previous questioner, is to know whether the schemes are economically sound, whether they are administratively possible, and whether they can be built in a reasonable time, so that the various sections can be joined up. Assuming that they are, are we going to prefer the overhead or the underground system? I would like to ask Mr. Watson what he feels is the advantage of being underground. Roof-top roadways will not involve a very material change to an already changing London, and we shall get a better view. I can only see one advantage in going underground, and that is safety. Most people prefer the air to crawling down in tunnels: I know I do.

MR. C. E. H. WATSON: I thought I made it clear in my essay that the great point of going underground was to leave old London much as it is, and I think that there are many millions of Londoners who feel that way. I was not born here but my father was a Londoner, I have lived here for twenty-one years, and I have come to the conclusion that even in a small village it is a colossal business to get even one small shop removed from the way of a new highway. There was a case of that at Walton-on-Thames. The process is so long when dealing with surface schemes that we seem to get nowhere.

As to the cost, I did stress that the first move was to make a comprehensive cost investigation to see what we are paying now. I should be very surprised if we are not paying a great deal more now than we would by using either of these two schemes. That has to be proved. I should like to see the answers.

MR. C. HAMILTON ELLIS: Mr. Watson would put the roads down in deep chalk, and Wing-Commander Cave-Browne-Cave would put them up on the roofs. Both speakers have acknowledged the usefulness of our reliable old friend the train. Why not put that down in the chalk? As far as we can guess, trains of the future will be electric and cars will have, not piston engines, but gas turbines. To put the cars down in the chalk will present a very great problem as far as the exhaust fumes are concerned. How much better to put the trains there!

Finally, may I say how very auspicious it is that on these handsome eighteenth-century murals, there is a very fine representation of a spiral ramp.

MR. NIGEL SEYMER: I should like to suggest an alternative way of providing 'expressways'—the name the Americans give the type of roadway we are talking about—which provides for the continuous flow of traffic at reasonable speeds. This method would consist in putting some (not all) of London's railways underground and building expressways in the place of the railways up above. As the last speaker has pointed out, when an electrified railway is put underground only moderate ventilation is needed, whereas with an underground road carrying heavy traffic ventilation is expensive. Apart from that, driving in a tunnel is not so pleasant.

This method could perhaps be applied in the case of the lines serving Cannon Street and Charing Cross. Many people have wanted to get rid of Charing Cross station ever since it was built in the 1860s; but it cannot just simply be removed—it is very well located from the point of view of the people who use it. An equivalent facility would have to be provided for these people before it could be removed; but this could be done fairly cheaply by providing two underground lines, one of which would cross the centre of London (probably linking with lines now terminating at Marylebone), while the other might link up with the Northern-City Line at Moorgate.

The railway lines having been thus buried, there would then be a very fine viaduct available on which to build a four-lane expressway which would serve as the South-Eastern outlet from Central London. Of course, this road would not terminate at Charing Cross. It would be continued as a 'depressed highway', perhaps along the line of Pall Mall and across the parks to link up with Western Avenue and the Cromwell Road Extension. Under Pall Mall the two carriageways might be placed one above the other, in a tunnel built by the 'cut and cover' method.

WING-COMMANDER CAVE-BROWNE-CAVE: I think that it is probably very much better to leave the railways alone. It would be a dreadful job shifting them. What I advocate is adding roof-top roadways in their own right. I did, in writing this paper, consider the possibility of using the old line which used to run from Blackheath Hill through Peckham Rye and Clapham to Addison Road, but there are great difficulties in getting it over an existing railway, and I myself would very much prefer to start with the scheme on its own merits by putting a roof-top roadway viaduct in place of some of the Route 11, for example, or the ring roads which are at present contemplated. I do not think that we want to make too drastic changes.

If Mr. Nigel Seymer can get the railways to Cannon Street and Charing Cross put underground, they should be replaced by roof-top roadways because the revenue from 100-foot buildings along those lines would be very great. It might be convenient to join up these two branches by a loop through Covent Garden and south of Holborn with garage spurs going into the three markets, which should certainly be taken out of the central area.

MR. C. E. H. WATSON: The question of ventilation certainly has not been overlooked. It was mentioned in the paper, but I should add that there would have to be ventilators at approximately one mile intervals on all the ring-roads and radial roads. I should like to see the whole question of tunnel ventilation examined afresh in the light of modern scientific trends. The utilization of part of the heat developed in safe, underground atomic power stations would minimize the problems of smoke, fuel supply and ash disposal, and the considerable depth of the tunnels seems to me to offer definite advantages for ventilation, because the long shafts to the surface would act like tall chimneys. The economics of tunnel ventilation would then appear in a far more favourable light. Just because the scheme is rather comprehensive I do not think that we need be frightened of it.

I went to a film the other day which showed the achievements of the Russians in linking up several great rivers and five seas by the Don-Volga Canal, and the quantity of material excavated was 5,000 million cubic yards. As far as I can calculate, something of the order of 500 million cubic yards would be involved in the total excavation of the tunnels, ramps and garages, and in including the ventilators and any pilot tunnels which might have to be put in. By comparison this is not so colossal. A special authority would have to be set up, perhaps on the model of the Tennessee Valley Authority which has done such great things in the United States. That all started with just an idea, and was brought to fulfilment by a lot of push and drive—which we seem to lack at the moment.

THE CHAIRMAN: As a matter of fact, an expressway on top of an underground railway is in existence in New York where the New York Central Line goes under Park Avenue. There the ventilation is all done perfectly simply. In Chicago the line is not even electrified; the smoke from the steam engine is sucked up without any difficulty. It is a simple engineering problem which has been solved.

MR. R. G. VOYSEY: I have been thinking of the question of cost, and I agree with the other speakers that it would be very rash to say anything definite until there is a thorough analysis of this; so my first question to the two lecturers is whether they have any concrete proposals for an organization that could undertake this financial investigation.

I am beginning to wonder whether a discussion of costs could take us any further, because, if we analyse the two propositions, the roof-top roads are revenue-earning through the buildings underneath them, and the maintenance costs should be small; the underground tunnels have to earn their revenue.

The cost per cubic yard of a tunnel and of a building would be roughly of the same order. Excavation costs underground vary: the cheapest—for washing out salt—is less than £1 a cubic yard, while excavating a coal-mine shaft, say, costs £3, and blasting tunnels through rock costs up to £7 or £10 a cubic yard. I believe that typical industrial buildings cost about £6 a cubic yard; I suppose skyscrapers would be more expensive, and might be as much as £12 a cubic yard. This does not seem relevant, however, because the buildings have a very high rateable value, whereas tunnels have to find some way of taxing the car, either by a toll or by some extra charge such as the present licensing tax. Perhaps the authors do not care to look so far ahead, but I wonder if Mr. Watson would say whether he has any opinions, at this stage, on the ways of paying for those tunnels.

MR. C. E. H. WATSON: I think the question is rather a difficult one, but I personally should not be satisfied until we have had this cost investigation. I think that many people do not understand the real meaning of cost. What is the cost of opening a hole in the road? It is not just the cost of hiring the men and the compressor for a week, it is also the cost of all the delay in the rush-hours to cars that are held up by that road-block. That does not go on the books, nor does the cost of a valuable life that

is lost through an ambulance not getting to hospital. That kind of thing is impossible to assess, but I think there have been guesses made already as to what we are losing now in the country by virtue of accidents and traffic congestion. It has been put at £200 million annually. That figure capitalized would provide a fair sum to set the wheels of construction going.

I am sorry that I cannot answer the question more fully as it really requires a great deal of investigation, and is not the sort of question that should be dealt with lightly.

WING-COMMANDER CAVE-BROWNE-CAVE: I think that this is a very pertinent question, and that is why I, at any rate, and I am sure Mr. Watson also, are so grateful to the Royal Society of Arts for having had this Competition. I think that the proper action to take is for the Royal Society of Arts to organize an investigation which will examine these proposals in somewhat greater detail, and find out how far they are sound. That must be done by an authority on which all the various factors concerned are represented and which can do it much more satisfactorily and much more reliably than any individual can.

MR. W. VANE MORLAND: I think that in considering these two excellent essays we must get our feet on the ground in order to deal with a problem which requires both a short-term and a long-term policy. I think possibly both the authors may agree that our immediate and urgent necessity is a thorough investigation into short-term remedies for the present state of affairs which will ultimately fit into the long-term schemes.

MR. C. E. H. WATSON: I feel the speaker is quite right about a short-term policy, and I have taken that into account. The initial period before anything was done at all, except thinking and planning, would possibly be four years, but the pilot tunnel system, ramps and car parks would be built in the following twelve years, so that the ramps could be used as car parks both below and above ground before ever the tunnel system came into use.

SIR ERNEST GOODALE: It seems to me that we have in the discussion rather lost sight of what was intended in the original papers. We should not be discussing a means of dealing with London's traffic as it exists to-day, but what will have in fact happened in A.D. 2000. I do not think we ought to go too deeply into what the cost of this or that would be at the moment, or what the short-term requirements of London traffic are, but what we must consider is whether we will have, by the year 2000, achieved a solution of the problem.

CAPTAIN A. CROMAR MITCHELL: I am a strong supporter of helicopter transport and recently, on paper, I took an advancing army on manœuvres from Frankfurt to Berlin, some 525 miles. I decided to put 10 tons of stores down in Berlin every hour. With 10-ton lorries that do not break down, with people who do not eat or sleep, it takes 147,000 vehicle-man-hours to do that. Now with the helicopter that we shall have in A.D. 2000, one can do not 10 tons but 640 tons an hour with the same number of vehicle-man-hours. One is entirely independent of bridge limits or weather conditions within certain limits, while should there be a single fire in one of the viaduct buildings there would be a hole in the roof-top roadway 100 yards long.

WING-COMMANDER CAVE-BROWNE-CAVE: I am sure that the Chairman would be able to answer that, and I would very much sooner have a first-class fire in one of the buildings forming a viaduct than I would in, say, the eighth story of one of his skyscrapers. I suppose, if I may guess the answer, that in a viaduct building there will not be sufficient combustible material to make a fire capable of doing enough structural damage to affect the viaduct as a whole. I think that the fire problem is soluble, although I must admit that I do not know what the answer is.

THE CHAIRMAN: In practically every skyscraper, of thirty stories or over, there is at

least one fire a week. I am not exaggerating when I say this, having been the designer of a good many of these buildings. They are fought automatically from the inside. The buildings are fire-proof structures. The fire is confined inside a certain limited space and is fought with fire-fighting facilities on the floor, and it practically never spreads. I know only of one fire, apart from the great San Francisco affair of 1907, when there was a lot of damage. That was in New York about 1919, and since that time I know of no skyscraper which has had a fire which the authorities have not been able to handle with the fire-fighting facilities already installed.

MR. BRIAN THOMAS: I am sure that by the year 2000 the problem will still be short-term communications. It is not worth taking a helicopter from St. Johns Wood to the Royal Society of Arts. I am not sure, however, that in that short space of time people will have become any more amenable about allowing their buildings to be swamped by vast structures carrying roads.

It did occur to me in Wing-Commander Cave-Browne-Cave's proposal of roof level roads that there is no reason why the road should go over the building. Would he say whether the scheme could be adapted to allow the roof-level roads to be slung between buildings so that they could follow the routes of the existing roadways, and duplicate them in two and possibly more stories, so that the London roads as they are at present would be relieved of all bus traffic?

MR. E. W. CUTHBERT: I am speaking for Sir William Halcrow, who regrets that he is unable to attend.

In order to forecast the future, we might take a look at what was said fifty years ago, comparing the situation then with what it is to-day. The Royal Commission on London Traffic, 1903–04, approved a Report by the Civil Engineer, Mr. Charles Meik—Sir William Halcrow's predecessor in his firm—who proposed a scheme for relieving congestion in London. It consisted mainly of a west-east route and a north-south route. The west-east route extended from Acton to East Ham; it was proposed that it should be a double-level avenue. On the upper level there were to be twin carriageways, and above them a suspended monorail railway. On the lower level were twin carriageways for slow moving traffic with a motor carriageway in the centre. Motor cars were an innovation then, and they were regarded as being vehicles which required a lane to themselves. The same principle of construction was to be followed for the north-south route from Tottenham to just north of Croydon. The total width proposed for those roads was 160 feet, and for parts of their length they were to follow existing roads, and for other parts they were to be new routes.

As a matter of interest, the west-east route follows almost exactly the route mentioned by Wing-Commander Cave-Browne-Cave: it lies north of Oxford Street, crosses Scrubs Lane where Western Avenue ends to-day, continues westwards and turns south at Wormwood Scrubs and thence to Acton and Osterley Park. Where traffic was expected to be lighter, single-deck roads 160 feet in width were to be provided with twin carriageways for heavy goods traffic, a motor-way in the middle and an overhead structure carrying a suspended monorail railway.

Where one of the double-level avenues crossed an existing street a 160-foot wide steel structure carried the avenue over the street, an overhead gantry carrying the monorails. The motor-ways were normally at ground level, but ramped up at 1 in 20 at the approaches to street crossings so that they were kept clear of the existing streets.

This was recommended in 1903, and you all know where we are to-day; a cynic might make a point from that of where we are likely to be in A.D. 2000. But we have come a little way in planning since 1903. The station proposed for Norbury on the overhead railway was on an island in the middle of the motor traffic, and there was no question of pedestrian subways being provided. All the passengers from the railway

would have to cross the main carriageways. This is happening in London at many places now, but we would not think of proposing it in any new plan.

An estimate was included in the Report for 27 miles of double-deck roadway and 21 miles of single-deck roadway, making a total of 48 miles. It was estimated that in 1903 the acquisition of lands and buildings would cost £71 million, the road works themselves £21 million, and the suspended railway £9 million, making £100 million for 48 miles of route—something over £2 million a mile.

The population of London in those days was approximately five million, and the scheme was designed to serve a population of seven million. Considering the present-day value of money, and the building which has gone on since London had a population of five million, one can imagine the present-day cost of such a scheme as was recommended in 1903.

With regard to Wing-Commander Cave-Browne-Cave's proposals, I think that the ramps by which access is gained from existing streets to any overhead roads are most important features. The overhead roads would not be intended for through traffic; they would be intended to serve traffic which had to get to the middle of London. The through traffic travels on bye-passes, and does not enter the centre of London at all. Therefore I consider that the absolute minimum spacing of the ramps should be one mile, and I should not be happy with ramps having gradients of anything like 1 in 6, or even 1 in 12, particularly as heavily loaded lorries would be using them. In the weather conditions we get in London I do not think one could rely on traffic coping with such gradients. Something like 1 in 20, or 1 in 25 seems to me to be more reasonable. Their length would be of the order of a quarter of a mile or even more. Furthermore, ramps 70 feet wide are intended to come down to the existing roads. There are not many streets existing to-day with a clear width between building lines very much more than 70 feet. A ramp could not therefore come down into an existing road without closing that road to local traffic. Therefore the construction of each ramp would apparently involve considerable demolition of existing buildings alongside the present roads in order to get the ramps down to ground level.

Whether we favour tunnels or overhead ways, we should not put too much faith in roundabouts. If any of you have seen roundabouts on the North Circular Road where it intersects existing radial roads in peak hours, you will probably have noticed that two policemen were required to keep the traffic moving at all. At one of the intersections, between Neasden Lane and the North Circular Road, the roundabout has been completely done away with and traffic lights have been substituted, with the result that nearly all vehicles have to come to a dead stop. Any form of flat intersection, even a roundabout, is not the answer. We must adopt the full clover-leaf type of intersection. I do not think that the space between existing buildings of up to 100 feet would allow for the construction of roundabouts having reasonable filtering facilities even for moderate traffic, as the inner circle would probably be restricted to about 60 feet diameter in order to provide a 20-foot wide carriageway all round.

We must provide for peel-off lanes in advance of any turn-off to a ramp. It is undesirable to provide turnings directly off the main carriageway, because a vehicle leaving the main stream would have to reduce speed to about 10 miles per hour, and that would mean that traffic behind would be held up. Facilities would have to be provided for the traffic to leave the main carriageway at full speed and to decelerate in a lane parallel with the main road before descending the ramp.

THE CHAIRMAN: With regard to putting a thoroughfare between two walls in a street, that is a simple description of the elevated railway that is running in the Bowery and on Fourth Avenue in New York, and it has been found that as a result of that, the dirt on the railways blows into the windows on either side, and it makes

so much noise that no one can sleep in the houses adjacent to them. In addition to that, there is no privacy in any of the houses, and therefore the properties are valueless, so they are being pulled down as quick as they can. The theory is sound, but in practice it really does not work out.

WING-COMMANDER CAVE-BROWNE-CAVE: The criticisms which Mr. Cuthbert made are vital, and I am most anxious to meet them. The gradient on many A class roads is greater than 1 in 6, and lorries seldom have any difficulty on them. Now I am proposing 1 in 12, and I am not going to put those gradients on a main road but on the spurs which come down from the road to the traffic system below. I am quite sure that 1 in 12 or 1 in 10 is sufficiently moderate. The width of those spurs is dictated not by the volume of traffic which will flow down them to the ground-level system, but by the space which is necessary to let the vehicles turn into the garage accommodation and the width which is desirable from the garage accommodation point of view, because, as I said earlier in the discussion, you can have the spurs as long as you like according to the amount of garage accommodation which you wish to provide.

I entirely agree about the ineffectiveness of the large roundabouts on the main roads. My roundabouts are not on the main roads but are under them, and they are used only by the vehicles which are coming down from the main road into the traffic system, or which are changing over from one lane to the other. The flow round those roundabouts will be very much less, and the roundabouts are fed by peel-off lanes. The restrictions of my drawing make the peel-off lanes quite short. Obviously they must be longer than that, and the existence of peel-off lanes at the side of the structure means that the size of the roundabout is, in point of fact, wider than the width of the roadway.

MR. C. E. H. WATSON: In reply to Mr. Cuthbert, roundabout seems to be a most unfortunate expression of mine. As with Wing-Commander Cave-Browne-Cave's scheme, I have tried to make it clear that mine is a two-level one. With regard to the peel-off lanes, I agree entirely with Wing-Commander Cave-Browne-Cave that they are vitally necessary.

THE CHAIRMAN: I know that you will wish me to thank these two gentlemen for their inspiring, thought-creating and provocative comments, and I, on behalf of everyone here, thank you, Wing-Commander Cave-Browne-Cave and Mr. Watson, for the very stimulating talks which you have given us this afternoon.

I feel that I am justified in thinking that these suggestions are but a part of the things that we need to solve the problem. I should think that the result will be that probably both of these ideas will, in some form or another, together with others which we cannot guess at to-day, be used.

The vote of thanks was carried with acclamation and the meeting then ended.

THE BICENTENARY COMPETITION

GENERAL REPORT

A short announcement of the prizes awarded in the Society's Bicentenary Competition was published in the *Journal* on the 29th October, and it is now possible to give a fuller report of the whole Competition.

The texts of the entries by Wing-Commander T. R. Cave-Browne-Cave and Mr. C. E. H. Watson, which won the first two prizes awarded, and which were read at a meeting of the Society on Wednesday, the 24th November, together with a report of the discussion which took place after the readings, are printed on the previous pages. Summaries of the three other prize-winning papers are printed below.

The decision that the Society should, in its Bicentenary year, hold a Competition dealing with the future was first announced by His Royal Highness the President at the Inaugural Meeting of the last Session, and was consistent with the importance which was stressed by the President of the Society retaining its ability to look ahead. Such a Competition, it was felt, would give an opportunity to the more imaginative to submit constructive ideas, and, even if it produced few practical proposals, would serve a useful purpose by directing attention to the future and its problems.

The great interest taken by the Press in the Competition and the publicity which has been given to it have certainly helped it to achieve this purpose. Articles about the Competition have been published not only in the leading London and provincial papers throughout the United Kingdom but in those of the Commonwealth countries also, and a number of enquiries about the entries have been received from representatives in this country of the American Press.

It will be remembered* that the competitors were asked to provide a forecast, either in writing or in some visual pictorial form, of a single practical aspect of life on this earth in the year 2000. That year was chosen as being sufficiently distant to allow for originality, which competitors were told was to be a particularly important element in their entries, and, at the same time, sufficiently foreseeable for it to be possible to require that forecasts should be realistic.

The quality of the entries was on the whole disappointing and, as has already been announced, the judges did not find any that were good enough to be recommended for either the first prize of £250 or the second prize of £100. In the result they asked the Council to award only five of the thirteen prizes originally offered.

The general criticism was that there was little originality in most of the ideas

* Full details of the Competition were printed in the *Journal* on the 27th November, 1953.

submitted and, where this was present, the suggestions were usually too fanciful to satisfy the condition that they should also be practical.

Altogether 184 entries, 163 in written and 21 in visual form, were received, of which a few had to be excluded because they broke one of the basic rules, such as that they should not exceed 3,000 words. A great variety of subjects was covered and it was essential for judging purposes to group all the entries under one or other of eight different heads, for each of which a panel of expert judges was appointed.*

The heads were as follows:

Agriculture
Building and Planning
Domestic
Education
Industry
Medical
Recreational and other Cultural and Social Matters
Transport and Communications

Entries were received from all over the world: from Australia, British North Borneo, Italy, Kenya, Malta, New Zealand, Nyasaland, South Africa and South America; naturally the largest number were written in the United Kingdom and were concerned in consequence mainly with life in this corner of the earth. The competitors were of all types and from all professions. They included schoolboys and housewives, clergymen and doctors, journalists and authors, engineers and architects; there were entries from a watchmaker's journeyman, a university lecturer, a men's hairdresser, a Colonial Office civil servant, a retired army officer, an evolutionary mystic and a professor of classical archæology turned bus conductor.

Most competitors assumed that civilization would not have been fundamentally changed by any major disturbance during the next forty-six years, although several foresaw a major war happening during this period. An enterprising pessimist, however, having described Utopian developments in transport in the year 2000, then dismissed them as figments of a dream, since in reality a cataclysm would have destroyed almost the whole population, and left the few survivors in need even of shoes. For the most part a development of present tendencies was expected and therefore immediate problems were given chief consideration. Particularly prominent were the problems of population increases with the resulting shortages of food; expedients for dealing with these ranged from the placing of potential mothers in cold storage to the production of food by microbiological means.

Other urgent problems were the economic production of power, the improvement of traffic conditions in cities, the control of disease, and the cleaning of the atmosphere in cities.

* The names of the judges are printed on page 67.

As most of the problems considered inevitably had their origins in those of the present day, so the suggested means for dealing with them were developments of present techniques rather than complete innovations. There was general optimism about the possibilities of atomic energy and, in particular, of fission products. Electronics also were looked to as one of the most important sources of future development. A more spectacular development, and one which suggested the influence of current books on science fiction, was in interplanetary flight, which many competitors assumed would be common at the end of this century.

Not all competitors saw the remaining half of this century as a period of radical change, and while there were those who predicted a 'brave new world' already by A.D. 2000 in which pre-conditioned, hypnotically educated and synthetically fed population units would be controlled with a Spartan-like regimentation, there were others who envisaged slower and duller developments. According to one, 'As the year two thousand thunders in with that portentous plop, that mildly derisory anti-climax which is the fated doom of the purely chronogrammatical jour de fête, the chances are three to one or thereabouts that in Southern England it will be raining'.

Many of the varied ideas contained in the entries are of interest, not only for the pictures they give of the world of the future, but for illuminating a little some dark corners of the world of to-day, and emphasizing its special problems. It is not only the forecasts which make one sit up, nor present-day planners alone who may wish to take note of them: the knowledge that in the year 2000, as one competitor reports, 'Mabel prefers the sound radio when she is alone at home and wishes to concentrate on other things' should give pause to planner and reformer alike and may, as well, be of interest to a future historian. Accordingly, in the following collection of predictions taken from some of the entries, suggestions have been included which, while perhaps having no originality or value as pointers to future developments, may be of interest both to present readers of this *Journal* and to those of a later date.

SOME OF THE FORECASTS

Communications

The rocket letter post will have made return mail to Australia in a single day possible.

Pedestrians will move quickly along main streets on automatic speed walks. Pavements in main streets will be raised to first-story level to allow wider roadways for the traffic below and passengers can therefore board buses from the top deck.

Airports will require much less surface area as most of each runway will be underground.

Flying heights will be prescribed for all aircraft and will depend on the directions of flight.

Lorries will have pointed rears to make seeing from behind them, and consequently overtaking, easier.

A Channel tunnel will connect England and France.

Heat, Light and Power

Numbers of space stations will be placed around the earth at heights allowing them to nullify gravity: they will provide bases for space explorations and for concentrating solar energy for use on the earth.

Domestic heating and ventilation will be controlled by covering each house and garden with a plastic shell entered by an airlock.

A single vast plastic dome will cover London.

Sources of domestic heat will be cosmic rays and solar energy.

House lighting will be provided from fluorescent walls.

The coal industry will have had a great revival but coal instead of being burnt as fuel will be used entirely for its various chemical derivatives. Gas and electricity will be depended on for heating; coal will no longer be burnt to provide this because, apart from the waste involved, it will have been discovered that, with oil, tobacco and radio activity, coal smoke is a common source of cancer.

The electrical grid system will be on an international basis.

A start will have been made in the radio transmission of power and in the bulk storage of electricity.

Education

No specific subjects will be taught in schools: education will consist of games and occupational therapy.

Hypnosis will be used as a mechanical aid to learning.

Great importance will be attached to voice training as a result of the development of television and recorded talks.

Co-education will be the usual form.

Agriculture and Forestry

Timber will be cut electrically, by a form of electric charge, to any desired shape, thus avoiding the double process of sawing and planing and consequent waste.

Sweetcorn and vines will be extensively cultivated in the south of England.

Spraying and dusting soil with special preparations at the time of seed sowing will have done away with the need for weeding.

Farmyard manure will have almost entirely been replaced as a fertilizer by sewage sludge, town waste, and many industrial waste materials.

Food

There will be edible acorns and sugar will be made from wood; the use of wood for anything but food will be prohibited in the United States.

A meatless vegetarian diet will have become compulsory to avoid the land waste involved by meat production.

Packaged foods will be the basic diet. 'In time only the fostering of a creative urge in the cook will prevent the disappearance of effect and novelty on the table.'

Sea mosses will be cultivated as food and the British product will be acknowledged to be the best in the world. The harvesting of plankton will have developed into a highly organized activity.

Conventional distinctions between different types of meals will have disappeared.

Industry

Advertisements will be projected on to the night sky and space will be sold by reference to the position of the stars.

Solid plastic tyres will have succeeded the pneumatic type.

Whales will be kept in captivity, bred and herded like cattle.

The discovery of oil in Ireland will have led to rapid industrialization there and to the ending of partition in 1974.

Science

A device will have been invented to prevent at a distance the fission of atomic nuclei, and thus will counter the dangers of atomic bombing.

Medicine

Radio therapy will be the basis of medical diagnosis and treatment since the discovery that all virus and bacteria radiate detectable energy on fixed frequencies related to their particular species.

Hypnotism will be the accepted means of banishing physical and emotional pain.*

The treatment of wounds will have been made easier by use of transparent medical wrappings.

The greatest advance in medicine will have been the recognition that physical and mental illness are connected and must be treated together.

Virus infections will still be rampant through their tendency to modify themselves to meet new treatments.

General

Painting will be a universal form of recreation.

All clothes will be easily washable and more strictly functional than hitherto.

Family life will have been revived by television.

A new drug will have produced a variety of giant-sized animals. They will have a shortened life span and great appetites, but these will be met by a new type of fodder.

An effect of the general reduction of atmospheric pollution will be the increased use of brighter colours, particularly in textiles.

A new human species will have appeared as a result of mutation, with two heads and four arms, the better able to assimilate the complications of our civilization: the finest qualities in man will thereby have been doubled.

The minimum marriageable age will be 24 for men and 20 for women.

Staggered shopping hours will have avoided the former dreariness of closed shops.

* An illustration given is a couple seeking escape from a top-story fire: the man, not previously conditioned, suggests to the conditioned woman that she should fall into a rigid trance, thereby providing him with a plank on which to escape *via* a near-by tree. He then recovers the plank.

*SUMMARY OF THE OTHER PRIZEWINNING ESSAYS**

'SYNFOOD'

MR. F. R. EAST, A.C.I.S., of Horbury, near Wakefield, a retired National Coal Board Official, wrote an essay on 'Synfood', which is a group of new synthetic foodstuffs. It took the form of a report on broadcast talks given by a university professor of technological politics in A.D. 2000, on the eve of the erection of twenty large plants for the production of human food from inorganic materials.

The first part of the talks dealt with the characteristics of Synfood; the second, with its origin and development and the third, with its possible social effects.

The foods had been tried on a number of island communities and proved themselves to be health-giving and wholesome; their pleasant taste was like nothing else and marked an important departure from the earlier 'nut cutlet' principle of aping existing tastes in order to overcome the popular prejudice against synthetic foods—a prejudice not shared by the lecturer who demonstrated his disagreement with it by spelling Synfood with a 'y'.

The origins of Synfood sprang from researches into the constitution and synthesis of organic substances in the middle 'fifties. Most of the vitamins were then synthesized and cheap processes were soon developed for the artificial photo-synthesis of starches and sugar. Atomic plants contributed to the production of Synfood by providing cheap electric power and quantities of isotopes to be used not only in research but as catalysts in the actual production.

These developments made it possible to produce cheaply the four chemical elements, hydrogen, carbon, oxygen and nitrogen, which made up the bulk of our food: oxygen and hydrogen could be made by electrolysis, nitrogen from the air, and carbon either by artificial photosynthesis of the carbon dioxide in the air or from anthracite coal. Synfood entailed very heavy capital expenditure on the plants required to synthesize the food from these elements; their potential output was so great, however, that in the result Synfood would be cheap.

The lecturer described incidentally some of the new types of machines, which worked by sight, used in the plants; among them was an enormous mechanico-electric monster which was used to detect and demolish scrap-iron.

Because of its many virtues Synfood would eventually be universally adopted. Many consequences, some more and some less important, would result. The food barriers dividing certain religions would entirely disappear. Agricultural workers would no longer be needed since between 30,000 and 50,000 workers in Synfood plants would be able to produce all the food needed in Britain. Most important would be the incredible increase in the world's population, which unless strict birth control were introduced, and families limited to two children,

* For each of these entries a prize of £10 was awarded.

would result in the world's becoming overcrowded and consequent shortages of such things as metal, the production of which had lagged behind Synfood. 'Instead of a world of gadgets and no food, we may have food and no gadgets'.

The lecturer accepting these implications, favours the adoption of Synfood, which he considers now inevitable, believing that it will bring about for a time a period when everyone is well fed and healthy, and therefore probably happy, before the world almost inevitably becomes overcrowded.

MICROBIOLOGICAL PRODUCTION

MR. M. B. MCEVEDY, M.A., B.M., B.CH., D.OBST., R.C.O.G., D.M.R.T., a medical practitioner of Withington, Manchester, based his essay on 'Microbiological Production' on a talk by the Director of a Microbiological Products factory in the year 2000 to visiting students.

The director first reviewed the events which had led to microbiological production, and explained that by the middle of the twentieth century the most urgent problem facing mankind had become the scarcity of food. It was realized that a solution could not be provided by agricultural improvements alone, and that even if coupled with a chemical approach such as the direct chemical synthesis of fats, which by themselves would be inadequate on account of cost and of the inadequate vitamin content of the food produced, these would not be able to deal with a world population likely to have grown by the end of the century to more than 3,700 millions.

Microbiological production of food appeared to be the only answer. By 1950 two methods of food production using micro-organisms had been considered: the first, photosynthesis, using unicellular plant such as chlorella; the second, food yeast grown on waste carbohydrate. The first remained unimportant because of the inefficiency of the method, the second, mainly because of the unpalatable nature of carbohydrate. It was realized that any practicable microbiological process should permit deep culture, requiring that the energy-giving substrate should be evenly distributed through a large volume of water, and should be anaerobic, to save energy in aeration and filtering the air; it was also necessary that the energy-giving substrate should be cheap to produce. Thus organisms using sulphur compounds or hydrogen as an energy source were to be selected, and hydrogen was to be preferred as being easily produced and not corrosive.

Consequently the food producing plant was planned to use hydrogen as energy giving substrate; hydrogen oxidizing bacteria as the 'fermenting' organism, and a nutritious protein-fat-carbohydrate-vitamin-enriched product.

The Director suggested a variety of schemes for producing hydrogen bacteria. The simplest involved the electrolysis of water producing hydrogen and oxygen; the second used the oxidation of water-gas to supply the hydrogen and carbon dioxide. A more efficient alternative combined the two processes supplying the necessary oxygen for the oxidation of the water-gas from the electrolysis processes. Yet another approach required the oxygen to be supplied from the

air either by conventional air liquefaction processes or use of the centrifugal gas concentrators which had been developed in the 1960s. These usually contained a suspension of vanadium oxides in 10 per cent sulphuric acid, an oxygen transporter known for many years to occur in the blood of tunicates. Such a fluid would absorb oxygen from high-pressure air and give it up when subjected to a vacuum in much the same way as does the human blood. Another source of hydrogen was the enriched atomic pile using water as a moderator or coolant. The radiation would split some of the water into oxygen and hydrogen, and it was possible to purify the hydrogen of all radio-active contamination by filtering it through hot palladium metal.

Since atmospheric nitrogen could be reduced to ammonia by some organisms in the presence of hydrogen, the Director explained that there was now no shortage of nitrate fertilizers. The amount of food that could now be produced thus depended only on the quantity of hydrogen available, and this, with atomic power from fission as a ready source of energy, was virtually unlimited. Thus in the year 2000 the world population had become three times what it was in 1950. In the Eastern world the population then subsisted mainly on the primary product of the food machines, a vitamin-rich high-protein sausage of boiled hydrogen bacteria and bacterial milk produced by the ultrasonic disintegration and emulsification of a selected high fat strain of hydrogen bacteria. In the West and in America the diet consisted of pork, bacon, eggs and chicken, with bacterial milk, and bread and potatoes as farm-grown luxuries.

The Director next described the breeding pens at the top of the factory where sixteen identical female piglets were produced parthogenetically through the inclusion of colcichine derivatives in the diet of their mother. Each piglet had her six-hourly feed of bacterial mush piped into her cage while, once a month, the great collecting machine removed the pig, put in a new piglet and processed the pig meat.

He told his visitors that the only significant advance made in the use of waste products by micro-organisms was in the use of a selected strain of methane-producing bacteria which, when slightly poisoned by phenyl thiourea compounds produced the higher hydrocarbons propane and butane instead of methane. This disposed of the need to pressurize the gas so highly and, by using a higher concentration of enzyme inhibitor, liquid hydrocarbons could be produced as petrol and run off the top of the culture tanks.

The twentieth century had seen a growth in the number of useful compounds which could be produced by fermentation, but the main trend in the latter part of the century was towards the cheap production of more complicated substances, such as antibiotics against all known disease agents. While the early antibiotics such as penicillin and aureomycin were of a multicyclic ring structure, most of the anti-viral agents were polysaccharide in character. Specific poisons for almost all animal and plant pests were now made by bacterial synthesis. As a result of the production of the melanin inhibitor by streptomyces rubra, there were no black people left in Africa.

Bulk quantities of clothing yarn and structural material were also produced

in the factory by microbiological methods. The manufacture of clothing had been simplified by the discovery that certain species of streptomyces, when grown in a low concentration of bacteriostatics, were prevented from dividing into separate cells and produced long filamentous forms from which threads could be formed. Most clothing was now made from a wool-like yarn formed from the resulting threads, and the Director himself was characteristically dressed in a knitted garment made of bacterial wool.

Two important developments, using fermentation methods, made in the production of ready made products, had had revolutionary effects on light engineering. The first was the production, by fermentation, of a resin which could be readily converted by the application of ionizing radiation and consequent cross-linkage into a hard, clear insulating material. The second was the production, by fermentation of simple sugars, of crystals of astralite. The production of a carbon molecule with a carbon atom at each angle of the dodecahedron provided a light, hard and slightly elastic material ideal for aeroplane manufacture. It was impossible to manufacture such a solid by standard chemical means but by chlorinating a heavy gas, produced from methane-producing bacteria found in the Amazon basin, which was made up of simple dodecahedrons of carbon atoms, the crystals could be built up. The usual commercial form of the material was rods or sheets made by the bonding of small crystals in a plastic matrix.

EDUCATION

THE REV. C. W. GIBBONS, B.SC., of Barrington Vicarage, Cambridge, begins his essay on 'Education' with the assumption that the world situation in A.D. 2000 will be one which we should wish our children to inherit. He makes two further basic assumptions: the first is that world unification, which will already have come about by the end of the present century, will be accepted as the guiding principle of statesmanship; and the second is that the main object of scientific enquiry is to elucidate the nature of man and of culture—in the sense of all in human behaviour that has been acquired by learning.

Mr. Gibbons refers to three types of educative process: the unconscious conditioning by environment, the later, semi-formal education in behaviour learned at home, at work, and in recreation, and finally, the formal type of education which consists of schooling and vocational training. He confines his study to the third type.

The frequent conflict of purpose between the teachers and the rest of the community will have been ended by the appointment of special departmental educationists who will, by social studies, assist management and others concerned to bring working conditions into line with the social aims taught in the schools. Thus teacher and administrator will jointly seek both to supply the material needs of the world and to foster the growth of human personality. Above all, teachers will be trained to view their particular subjects in their proper relation to the wider field of knowledge.

Since national rivalries will have ended, there will be a consequent increase

in wealth and leisure, and the principal object of society will be to maintain the material frameworks of life and to cultivate the arts of peace. Hence there will no longer be an urgent need for specialist technicians and the schools will be able to provide a more generalized education than hitherto.

The new age, with its utilitarian cosmopolitanism, will be marred, however, by a drab sameness, and to avoid the resulting boredom, there will be a revival of interest in the old national and local cultures. A new form of patriotism will thus emerge but to prevent this disrupting the new cosmopolitan economy, it must be unchauvinistic, and the basic education, which will be an essential qualification for citizenship, will concern itself with imparting a fundamental understanding of the nature of man and of culture based on historical study. This education will consist of the cultivation of three types of awareness: the first, full intellectual self-awareness of an all-round kind, but allowing older pupils to specialize in subjects for which they show a particular flare; the second, an awareness of the pupils' cultural heritage, both national and international, and of the former's dependence on and obligations to the cosmopolitan economy of the unified world; and thirdly, awareness of the rules that must be played in life and the importance for their successful fulfilment of a zest for mental and spiritual growth. The writer emphasizes the need for appreciating that the educative process continues throughout life and that an understanding of the underlying significance of human institutions should be taught from the start. He suggests bringing the young into early contact with the adult world, through the joint participation of the schools and the community on important occasions in new forms of social ritual.

The last stage of schooling will be a form of national service where experience of adult occupations will be combined with that of a wide use of leisure. For girls this period will frequently be spent in 'qualified' homes where the domestic arts will be learned.

The basic education will be religious and, as a result of the renaissance of the national cultures, the religions which they enshrine will acquire a new importance. Their emphasis on personal freedom and responsibility will offset the tendency of a deterministic outlook to gain control. As well as giving social rituals the ultimate authority which they require, religion will give to all the chance of finding an answer to the problems of life which reason alone cannot give. The greatest adventure of all will be in the ultimate growing together of the various age-old religious systems into a world faith.

LIST OF JUDGES

Agriculture

Sir William Ogg, M.A., Ph.D., LL.D., Director, Rothamsted Experimental Station (*Chairman*).

Viscount Hudson, P.C., C.H.

Mr. W. H. Cashmore, B.A., N.D.A., Director, National Institute of Agricultural Engineering.

Building and Planning

Sir Alfred Bossom, Bt., M.P., F.R.I.B.A. (*Chairman*).
Sir Hugh Casson, R.D.I., M.A., F.R.I.B.A.
Sir George Burt, M.I.C.E., Director, Messrs. John Mowlem & Co., Ltd.

Domestic

Miss Anna Zinkeisen, R.O.I., R.D.I. (*Chairman*).
Mr. H. P. Juda, Editor, *The Ambassador*.
Miss Elizabeth Craig.

Education

Sir Griffith Williams, K.B.E., C.B., lately Deputy Secretary, Ministry of Education (*Chairman*).
Sir Richard Southwell, M.A., LL.D., D.Sc., F.R.S.
Miss G. M. Colton, B.A., Headmistress, City of London Girls' School.

Industry

Sir Harold Saunders, B.Sc., F.C.G.I., late Comptroller-General, Patents, Designs and Trade Marks (*Chairman*).
Lord Halsbury, Managing Director, National Research Development Corporation.
Sir Graham Cunningham, K.B.E.

Medical

Sir Charles Dodds, M.V.O., D.Sc., Ph.D., M.D., F.R.S., Courtauld Professor of Biochemistry, University of London (*Chairman*).
Sir Selwyn Selwyn-Clarke, K.B.E., C.M.G., M.C., M.D., a Principal Medical Officer, Ministry of Health.
Sir Henry Cohen, M.D., Professor of Medicine, University of Liverpool.

Recreation, Social and Cultural

Sir Stephen Tallents, K.C.M.G., C.B., C.B.E. (*Chairman*).
Mrs. Mary Adams, O.B.E.
Sir Wavell Wakefield, M.P.

Transport and Communications

Mr. A. C. Hartley, C.B.E., B.Sc., F.C.G.I. (*Chairman*).
Mr. J. D. McGee, O.B.E., M.Sc., Ph.D.
Mr. W. H. Glanville, C.B., C.B.E., D.Sc., Ph.D., Director of Road Research, D.S.I.R.
Mr. B. N. Wallis, C.B.E., D.Sc., F.R.S., R.D.I., Chief of Aeronautical Research & Development, Vickers-Armstrongs, Ltd.

OBITUARY

ALBERT POTTS

We regret to record the death on 18th November of Mr. Albert Potts, the Senior Examiner in Typewriting to the Society. He was appointed in December, 1932, and through the years he worked zealously and successfully to maintain the standard of the examinations under his control. This contributed greatly to the ever-increasing demand in typewriting, and to the acceptance of the certificates for promotion purposes and the granting of proficiency pay. He will be missed by his friends on the staff.

SHORT NOTES ON BOOKS

RADIO ASTRONOMY. *The Royal Astronomical Society*, 1954. 6*s*

In this issue of the Royal Astronomical Society's *Occasional Notes*, members of the staff of the Experimental Station at Jodrell Bank have combined to give short accounts of some aspects of contemporary work in radio astronomy. Radio telescopes and the various heavenly bodies examined are discussed.

SIERRA LEONE: A MODERN PORTRAIT. *By Roy Lewis. H.M. Stationery Office*, 1954. 25*s*

This is the second volume of the Corona Library, a series of illustrated volumes dealing with the dependent territories of the United Kingdom. They are intended to be half-way between a blue book and a popular account. The volume is copiously illustrated and gives a short picture of every aspect of the land and people.

THEY LABOUR MIGHTILY: A TALE OF INSHORE FISHING IN WAR AND PEACE. *By Dora M. Walker. A. Brown & Sons*, 1947. 7*s* 6*d*

The author is the skipper of her own boat, and the life of a fisherman in peace and war, in calm and storm, is depicted in a series of vignettes. The book is copiously illustrated.

FREEMEN OF THE SEA. *By Dora M. Walker. A. Brown & Sons*, 1951. 10*s* 6*d*

This too is a series of sketches of life of fishermen, either based on the author's own experiences or on stories told to her by Whitby men and women. The stories cover from the last century and up to the Second World War. This book also is well illustrated.

FROM THE JOURNAL OF 1854

VOLUME III. *8th December*, 1854

From a note on The Consumption of Smoke in Paris.

The following order has just been issued by the Prefect of Police of the Seine:—

"Whereas the smoke of factories where steam-engines are used gives rise to continual urgent complaints. And whereas this smoke obscures the atmosphere, enters into dwellings, blackens the outside of houses and public buildings, and

produces great inconvenience and unhealthiness in the neighbourhood. And whereas it is important that such a state of things should be put a stop to, at a time especially when the City and the Government are making considerable sacrifices for the embellishment of Paris and its environs, and when so much attention is being given to the importance of the sanitary condition of dwellings, and the laying down better rules for the preservation of the public health. And whereas there are many known practical means of consuming the smoke produced by the combustion of coal in the furnaces of steam-engines, and experience has shown that these means can easily, and at a small expense, be applied to existing factories; and, besides, the employment of anthracite and coke is often economical, and produces but little smoke. And whereas steam-engines have only been allowed on condition of their not producing smoke to the injury of the neighbourhood, and besides the owners of such factories are bound by the terms of their licenses to comply with every condition which the Executive deems proper to prescribe, with a view to public health;

"It is ordered—

"That after six months from the date of this present order (ordonnance) the owners of factories employing steam-engines shall be bound to effectually consume the smoke produced in their furnaces, or to feed them with smoke-less fuel, such as coke or wood."

Some Activities of Other Societies and Organizations

MEETINGS

MON. 13 DEC. Geographical Society, Royal, South Kensington, S.W.7. 8.30 p.m. Charles Evans: *New Zealand Himalayan Expedition.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *Practical and Economic Problems in the Maintenance of Domestic Television Receivers* (Discussion).

Imperial Institute, South Kensington, S.W.7. 5.45 p.m. Duncan Carse: *Exploring the Islands: Expedition to South Georgia.*

Transport, Institute of, at 66 Portland Place, W.1. G. W. Quick Smith: *Road Haulage—a Re appraisal.*

TUES. 14 DEC. Civil Engineers, Institution of, Great George Street, S.W.1. 5.30 p.m. F. M. Lea: *Experimental Science and Civil Engineering Research.*

Industrial Transport Association, at the Royal Society of Arts, W.C.2. 6.30 p.m. R. Hill: *Research and Production of New Tyres.*

International Affairs, Royal Institute of, 10 St. James's Square, S.W.1. 1.30 p.m. Basil Woods: *East/West Trade.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. J. R. Ryley: *Cross and Crescent in Algeria.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 5.30 p.m. A. Towle: *Some Problems in Lubrication and the Substances called Additives.*

WED. 15 DEC. British Kinematograph Society, at G.B. Theatre, Wardour Street, W.1. 7.15 p.m. G. H. Cook: *Optical Developments Concerning Anamorphic Lens Systems.*

Central Asian Society, Royal, at the Royal Society, Burlington House, Piccadilly, W.1. 1.30 p.m. Sir Clarmont Skrine: *New Trends in Iran.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. F. B. Young and D. H. Tompsett: *Short-Circuit Forces on Turbo-Alternator End Windings.*

Eugenics Society, at the Royal Society, Burlington House, Piccadilly, W.1. 5.30 p.m. Peter R. Cox: *Some Demographic Developments in Great Britain since the Royal Commission on Population.*

Meteorological Society, Royal, 49 Cromwell Road, S.W.7. (1) E. J. Sumner: *A Study of Blocking in the Atlantic-European Sector of the Northern Hemisphere.* (2) L. J. W. Pothecary: *Short-period variations in Surface Pressure and Wind.* (3) E. B. Kraus: *Secular changes in the Rainfall Regime of South-East Australia.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.15 p.m. Margaret Medley: *Chinese Painting.*

THURS. 16 DEC. Chemical Society, Burlington House, Piccadilly, W.1. Prof. G. R. Clemo: *Some Newer Aspects of the Organic Chemistry of Nitrogen.*

Road Transport Engineers, Institute of, at the Royal Society of Arts, W.C.2. 6.30 p.m. S. H. Edge: *Automatic Chassis Lubrication.*

FRI. 17 DEC. Geographical Society, Royal, South Kensington, S.W.7. 5 p.m. C. S. Durst: *Accuracy of Dead Reckoning in Air Navigation.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 5.30 p.m. F. P. Bowden: *Recent Studies of Metallic Friction.*

SAT. 18 DEC. Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. T. L. Bartlett: *The Black-headed Gull.*

MON. 20 DEC. Geographical Society, Royal, South Kensington, S.W.7. 5 p.m. Terence Armstrong: *Northern Sea Route of the U.S.S.R.*

TUES. 21 DEC. International Affairs, Royal Institute of, 10 St. James's Square, S.W.1. 1.30 p.m. Prof. C. E. Carrington: *A New Theory of the Commonwealth.*

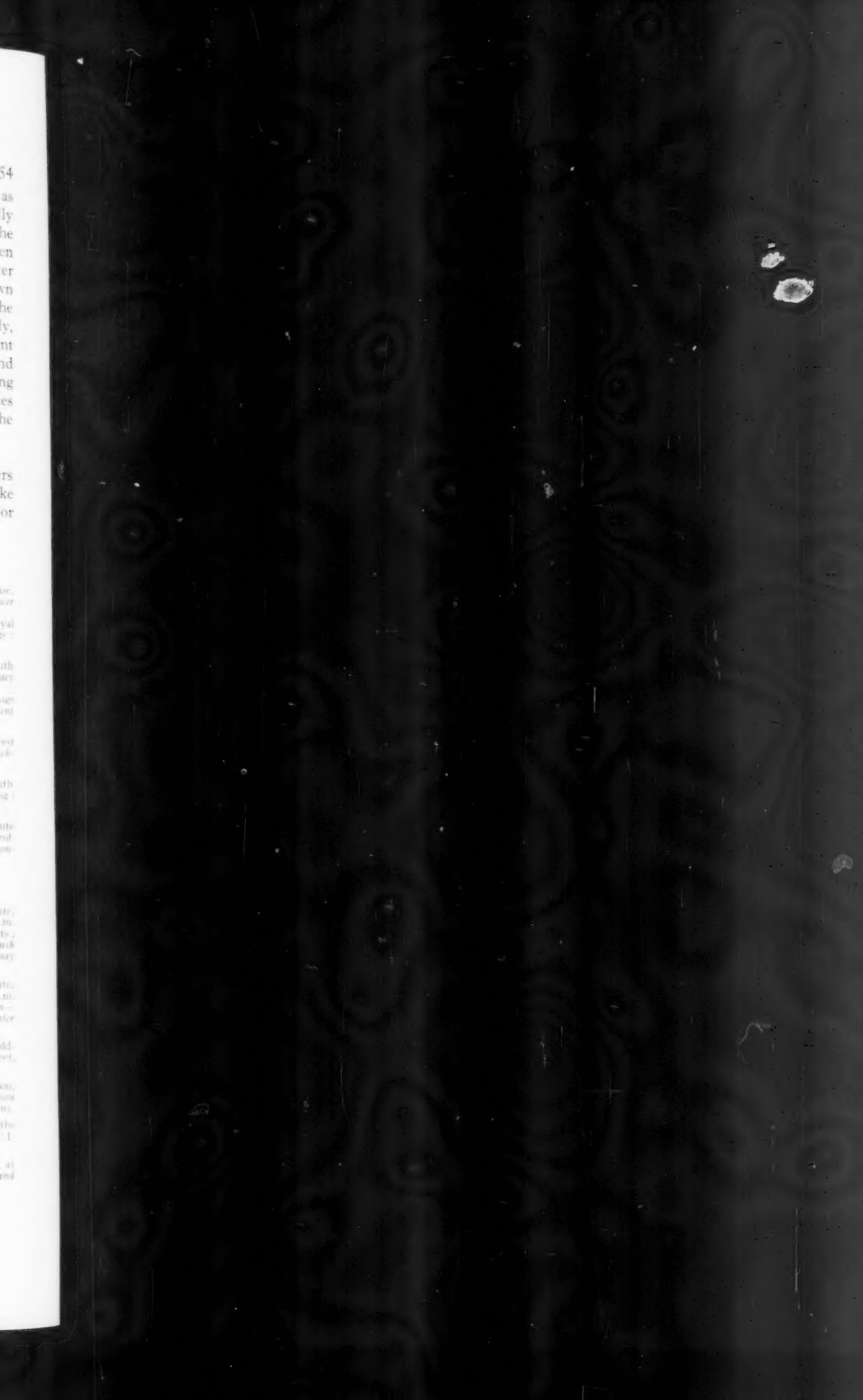
OTHER ACTIVITIES

MON. 13 DEC. UNTIL SUN. 19 DEC. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Weekdays, 3 p.m. and 4 p.m. Sats., 3 p.m., 4 p.m. and 5 p.m. Suns., Films: *Bush Harvests—Australia; Gold Coast People; Kootenay West—Canada.*

MON. 20 DEC. UNTIL THURS. 23 DEC. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Films: *Christmas Under the Sun—Australia; Santa's Foresters—Canada; Winter Carnival—Canada.*

NOW UNTIL 18 DEC. Worshipful Company of Goldsmiths, at the Tea Centre, 22 Lower Regent Street, W.1. *Exhibition of Modern Silver.*

NOW UNTIL 31 DEC. Imperial Institute, South Kensington, S.W.7. Exhibition: *Sir Alfred Bossom's Collection of the Arts and Crafts of the British Columbia Indians.*

NOW UNTIL 10 JAN. Portrait Sculptors, Society of, at the Imperial Institute, South Kensington, S.W.1. *Second Annual Exhibition.*

NOW UNTIL 16 JAN. The Arts Council of Great Britain, at the Tate Gallery. *Exhibition of Paintings and Drawings by George Frederic Watts.*